

F16.1 100

Source Local Address	Protocol	Source Port	Source Address Domain	Destination Address Domain	Translated Source Port	Source Global Address
A (host X)			1	2		A12
A (host X)			1	3	·	A13
A (host X)			1	4		A14

FIG. 2A

	Source Local Address	Protocol	Source Port	Source Address Domain	Destination Address Domain	Translated Source Port	Source Global Address
21-	A (host Y)			2	1		A21
	A (host Y)			2	3		A23
	A (host Y)			2	4		A24

F16.2B

And And And	Source Local Address	Protocol	Source Port	Source Address Domain	Destination Address Domain	Translated Source Port	Source Global Address
219 -	A (host Z)			3	1		A31
216 -	A (host Z)			3	2		A32
218 -	A (host Z)			3	4		A34

FG.2C

Destination Global Address	Protocol	Translated Destination Port	Source Address Domain	Destination Address Domain	Destination Port	Destination Local Address
A12			2	1		A (host X)
A13		_	3	1		A (host X)
A14			4	1		A (host X)
A21			1	2		A (host Y)
A23			3	2		A (host Y)
A24			4	2		A (host Y)
A31	· · —		1	3		A (host Z)
A32	<u> </u>		2	3		A (host Z)
A34			4	3		A (host Z)
В			0	4		В

FIG. 2D

The first from them that the the the

START 302	
Receive host local address, first address domain identifier, and second address domain identifier	304
	_
Select unique global address from a pool of global addresses	306
	1
Create a source address translation table entry in the first address domain's source address translation table mapping the host local address in the first address domain to the selected global address for the second address domain	308
Create a corresponding destination address translation table entry mapping the selected global address to the host local address in the first address domain	310
END 399	

F16.3

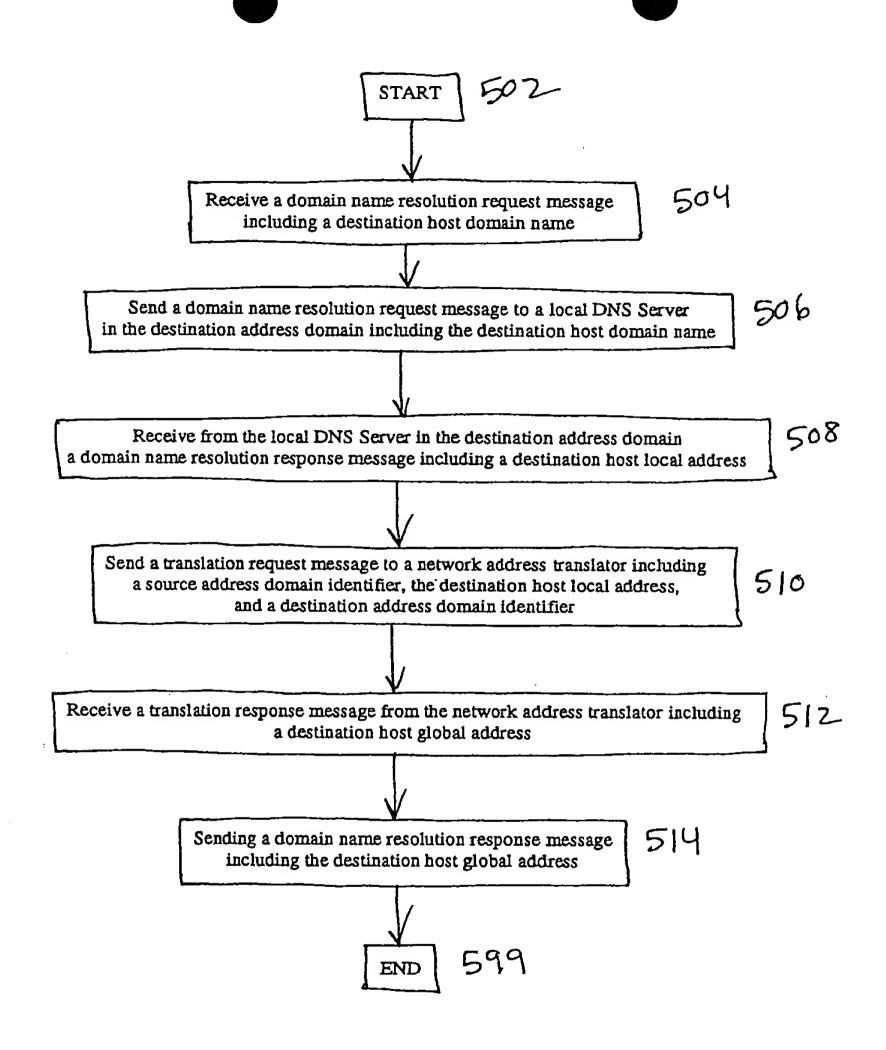
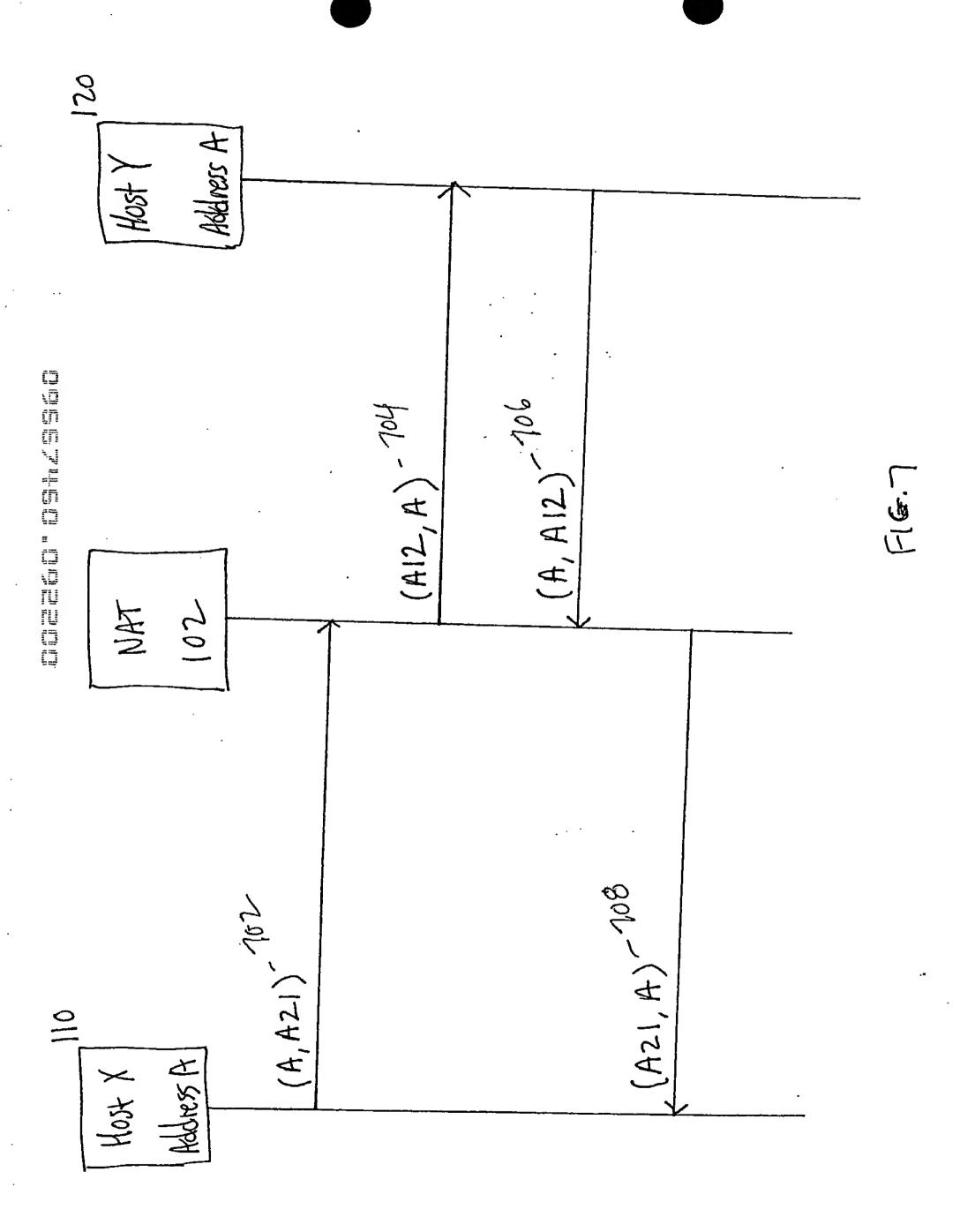
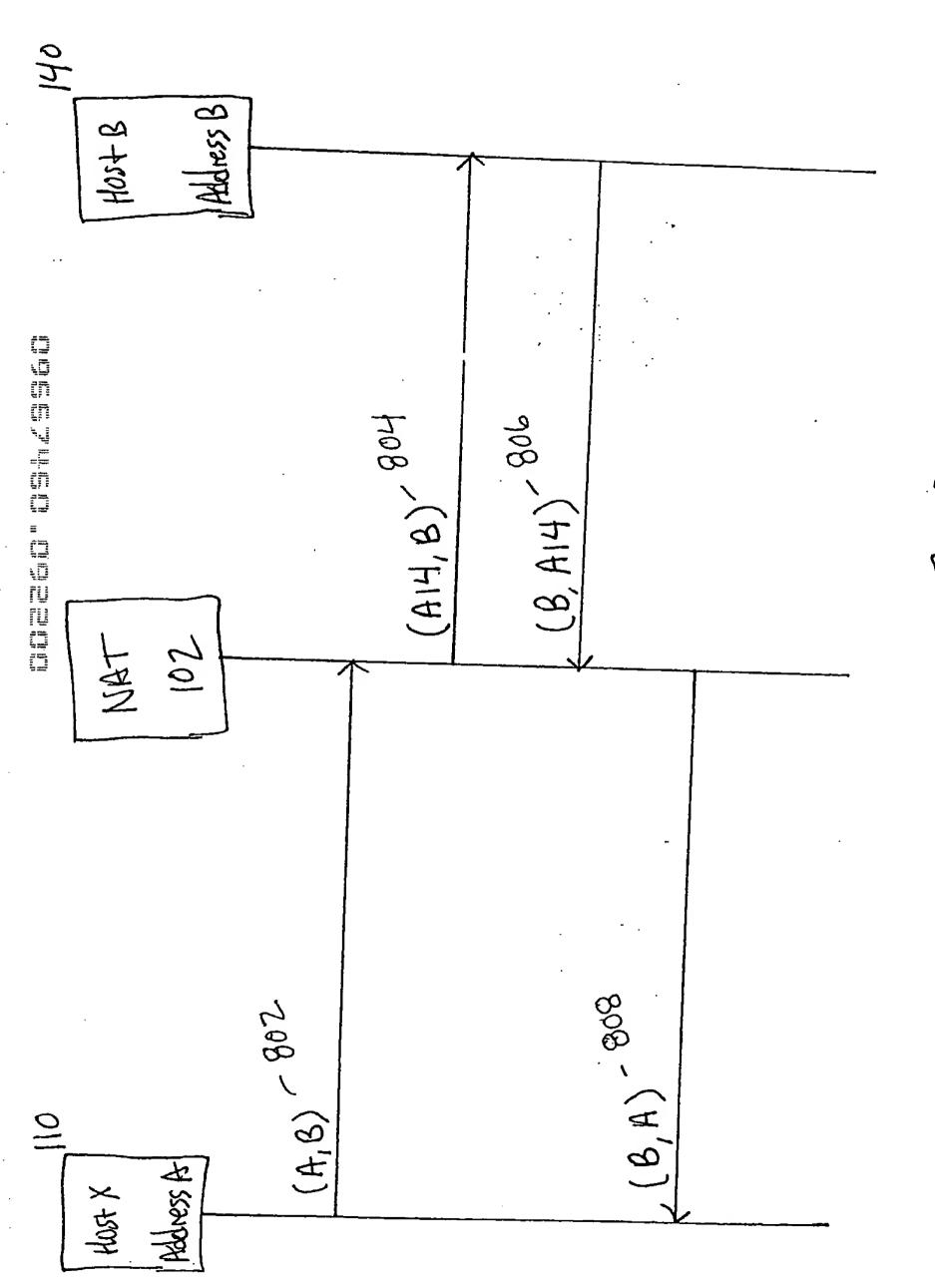


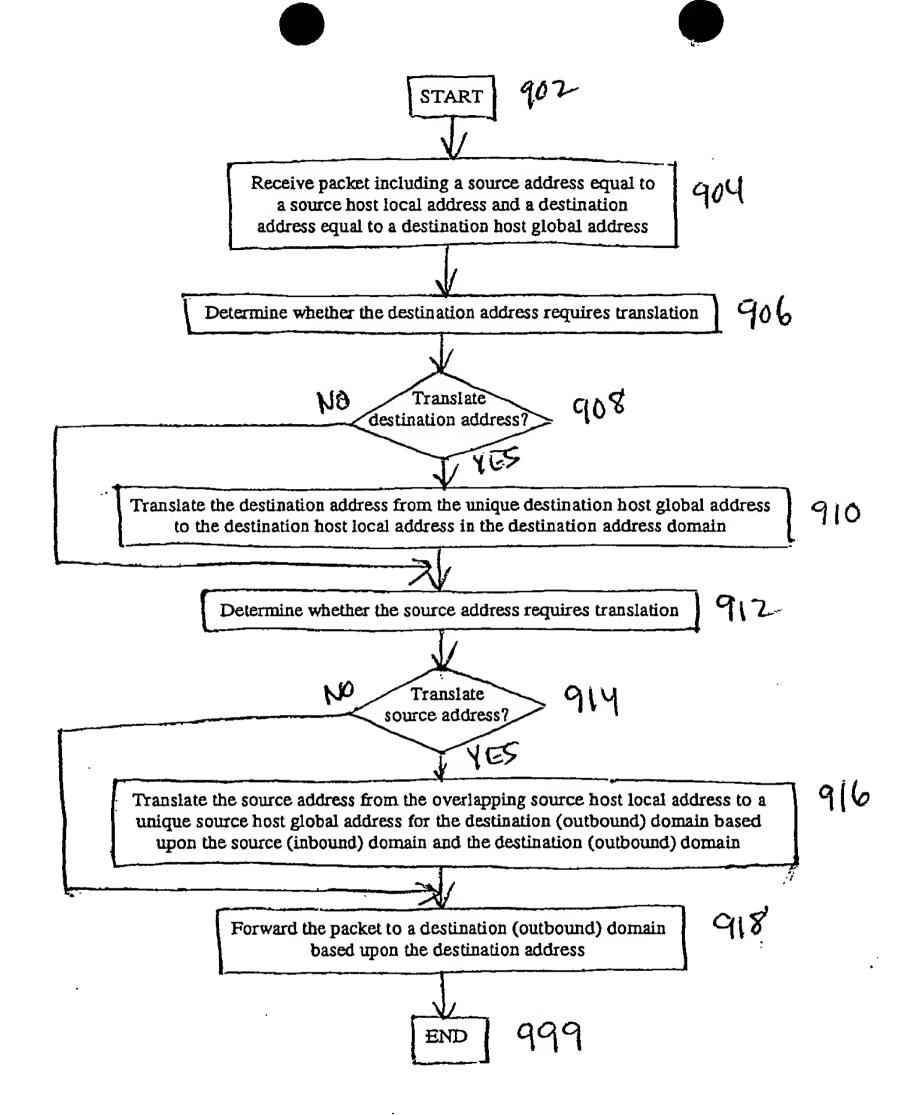
FIG.5

START 602
1.14
Receive a translation request message including a source address domain identifier, a destination host local address, and a destination address domain identifer
Search address translation entries for an address translation entry mapping the destination host local address in the destination address domain to a unique destination host global address for the source address domain
Address translation entry found? 608
INO
Select a unique destination host global address from the pool of global addresses 612
Create a source address translation table entry in the destination address domain's source address translation table mapping the destination host local address in the destination address domain to the destination host global address for the source address domain
Create a corresponding destination address translation table entry mapping the destination host global address to the destination host local address in the destination address domain
Send a translation response message including the destination host global address 618
[END] 699
FIG. 6





F1G.8



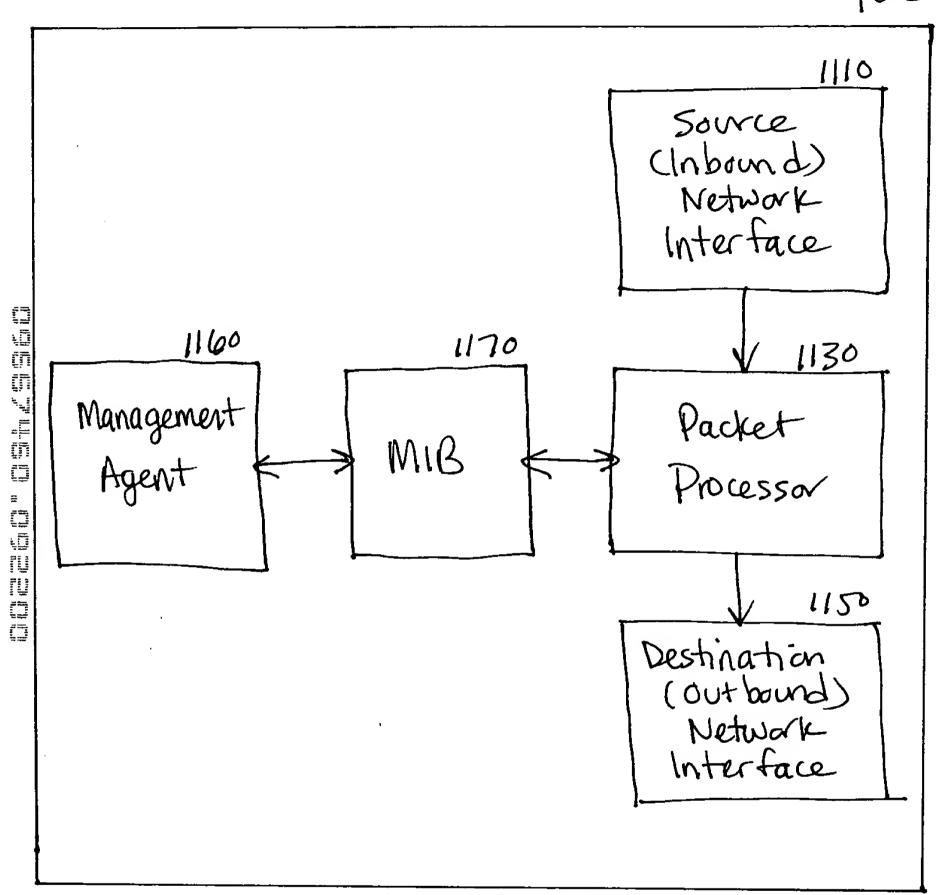
MG.9

START 10 10
Search destination address translation table for a destination address translation table entry mapping the destination host global address to a corresponding destination host local address in the destination address domain
Obtain destination host local address from the destination address translation table entry
Translate the destination address in the packet from the destination host global address into the destination host local address
END 1018

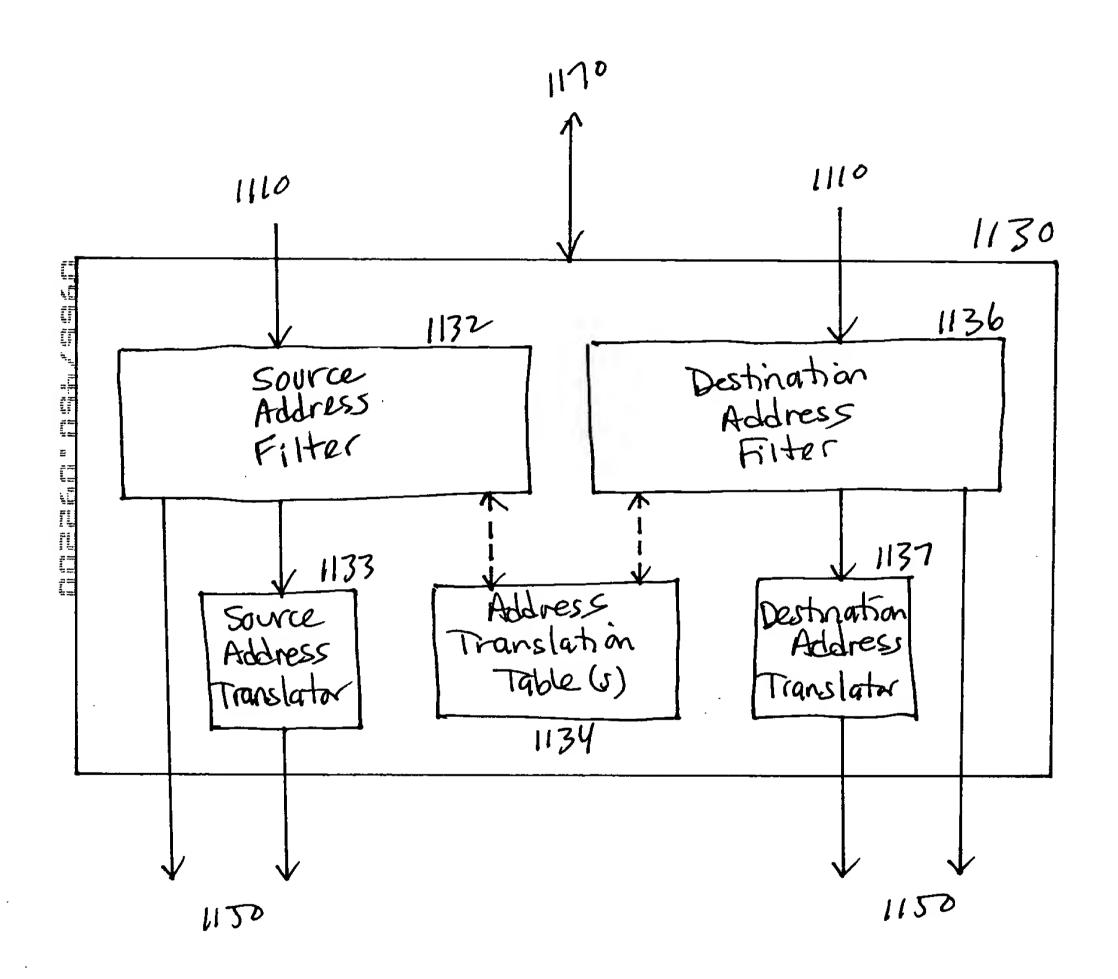
F16-10A 910

:

START 1020
Determine source (inbound) domain for the packet 1022-
Determine destination (outbound) domain for the packet based upon the destination address
Select a source address translation table for the source (inbound) address domain based upon the source (inbound) address domain for the packet
Search source address translation table for a source address translation table entry mapping the source host local address in the source (inbound) address domain to a corresponding source host global address for the destination (outbound) address domain
Jes
Address translation entry found? 1030
J. 140
Select a unique source host global address from the pool of global addresses 032
Create a source address translation table entry in the source address domain's source address translation table mapping the source host local address in the source address domain to the source host global address for the destination address domain
Create a corresponding destination address translation table entry mapping the source host global address to the source host local address in the source address domain
Translate the source address in the packet from the source host local address into the source host global address for the destination address domain
TEND 1040
F16-10B 916



FG.11 A



F16.11 B

Wellfleet-NAT-MIB DEFINITIONS ::= BEGIN

IMPORTS

```
IpAddress, Counter, Gauge
  FROM RFC1155-SMI
 OBJECT-TYPE
  FROM RFC-1212
 DisplayString
  FROM RFC1213-MIB
 wfNatGroup
  FROM Wellfleet-COMMON-MIB;
wfNatlfTable OBJECT-TYPE
  SYNTAX SEQUENCE OF WfNatlfEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "The set of interface that are participating
      in the NAT protocol."
  ::= { wfNatGroup 6 }
wfNatlfEntry OBJECT-TYPE
  SYNTAX WfNatlfEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "'An single instance of a NAT interface entry."
           { wfNatlflpAddress,
  INDEX
     wfNatlfCircuit }
```

::= { wfNatlfTable 1 }

FIG. 12A

```
WfNatlfEntry ::= SEQUENCE {
   wfNatlfDelete
     INTEGER.
   wfNatlfDisable
     INTEGER,
   wfNatlflpAddress
     IpAddress,
   wfNatlfCircuit
     INTEGER,
    wfNatlfType
       INTEGER,
    wfNatlfState
       INTEGER,
    wfNatlfTxCount
       Counter,
    wfNatlfRxCount
       Counter,
    wfNatlfPktDropCount
       Counter,
    wfNatlfDomain
      DisplayString
  }
wfNatifDelete OBJECT-TYPE
  SYNTAX INTEGER {
       created(1),
       deleted(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "This variable determines in a NAT Interface has been
      configured on the router."
  DEFVAL { created }
  ::= { wfNatlfEntry 1 }
wfNatlfDisable OBJECT-TYPE
  SYNTAX INTEGER {
       enabled(1),
       disabled(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "'The NAT interface's administrative status. The value
      'enabled' denotes that NAT has been configured
      on the interface. The value 'disabled' denotes that
      the interface is not running NAT."
  DEFVAL { enabled }
  ::= { wfNatlfEntry 2 }
```

Fig. 12B

```
wfNatlflpAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "The IP address of this NAT interface."
  ::= { wfNatlfEntry 3 }
wfNatlfCircuit OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "The circuit number of this interface."
  ::= { wfNatlfEntry 4 }
wfNatlfType OBJECT-TYPE
  SYNTAX INTEGER {
        uniDirlnbound(1),
        uniDirOutbound(2),
        biDirectional(3)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "Denotes the type of NAT interface being defined."
  DEFVAL{ uniDirInbound }
  ::= { wfNatlfEntry 5 }
wfNatlfState OBJECT-TYPE
  SYNTAX INTEGER {
       up(1),
       down(2),
       init(3)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "'The state of NAT on this interface'"
  DEFVAL { down }
  ::= { wfNatIfEntry 6 }
wfNatlfTxCount OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "Number of packets mapped over this interface from
      the local to the global network."
```

::= { wfNatlfEntry 7 }

FIG. 12C

```
wfNatlfRxCount OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "Number of packets mapped over this interface from
      the global to the local network."
  ::= { wfNatifEntry 8 }
wfNatlfPktDropCount OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "Number of packets dropped on this interface"
  ::= { wfNatlfEntry 9 }
wfNatlfDomain OBJECT-TYPE
  SYNTAX DisplayString
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "When wfNatlfType is set to biDirectional, specifies
     the Address Domain Name that this interface is
       connected to, otherwise set to null."
  ::= { wfNatlfEntry 10 }
```

FIG. 12 D

```
wfNatAddressRangeTable OBJECT-TYPE
  SYNTAX SEQUENCE OF WfNatAddressRangeEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "Table of address ranges. "
   ::= { wfNatGroup 8 }
wfNatAddressRangeEntry OBJECT-TYPE
   SYNTAX WfNatAddressRangeEntry
   ACCESS not-accessible
   STATUS mandatory
   DESCRIPTION
       "Information describing each of the available address ranges."
   INDEX { wfNatAddressRangeAddress,
        wfNatAddressRangePrefixLen,
        wfNatAddressRangeIndex}
   ::= { wfNatAddressRangeTable 1 }
WfNatAddressRangeEntry ::= SEQUENCE {
     wfNatAddressRangeDelete
       INTEGER.
    wfNatAddressRangeDisable
       INTEGER,
    wfNatAddressRangeAddress
       IpAddress,
    wfNatAddressRangePrefixLen
       INTEGER,
    wfNatAddressRangeIndex
       INTEGER,
    wfNatAddressRangeNto1Addr
       IpAddress,
    wfNatAddressRangeType
       INTEGER,
    wfNatAddressRangeDomain
      DisplayString,
    wfNatAddressRangeTransPool
      INTEGER,
    wfNatAddressRangeStaticNextHop
      IpAddress,
    wfNatAddressRangeUnnumCct
      INTEGER
  }
```

F16.12 E

```
wfNatAddressRangeDelete OBJECT-TYPE
  SYNTAX INTEGER {
      created(1),
      deleted(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "Create/Delete parameter. Default is created. Users perform
            a set operation on this object in order to create/delete
            an address range entry."
  DEFVAL { created }
  ::= { wfNatAddressRangeEntry 1 }
wfNatAddressRangeDisable OBJECT-TYPE
  SYNTAX INTEGER {
      enabled(1),
      disabled(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "Enable/Disable parameter. Default is enabled. Users perform
            a set operation on this object in order to enable/disable
            an address range entry."
  DEFVAL { enabled }
  ::= { wfNatAddressRangeEntry 2 }
wfNatAddressRangeAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "The IP beginning address of this range entry."
  ::= { wfNatAddressRangeEntry 3 }
wfNatAddressRangePrefixLen OBJECT-TYPE
  SYNTAX INTEGER (1..32)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
       "The number of contiguous bits set in the IP address mask
             which are used to define the address range of the entry."
  ::= { wfNatAddressRangeEntry 4 }
wfNatAddressRangeIndex OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "A unique value for this entry in wfNatAddressRangeTable."
  ::= { wfNatAddressRangeEntry 5 }
```

F16. 12 F

```
wfNatAddressRangeNto1Addr OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "When wfNatAddressRangeType is set to srcAddrFilter,
             specifies the N-to-1 translation address used for
       this range, otherwise set to zero."
  DEFVAL { 0 }
  ::= { wfNatAddressRangeEntry 6 }
wfNatAddressRangeType OBJECT-TYPE
  SYNTAX INTEGER {
         sourceAddrFilter(1),
         translationPool(2),
         domainSrcAddrFilter(3),
         domainTransPool(4)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "Denotes the type of address range being defined.
     sourceAddrFilter:
                           a range of IP addresses used to detect packets
            which need traditional NAT forwarding.
                           for traditional NAT forwarding, a range of
     translationPool:
            IP addresses from which translation addresses are picked.
     domainSrcAddrFilter: a range of IP addresses used to detect domain
            specific packets which need domain specific NAT forwarding.
     domainTransPool:
                           for domain specific NAT forwarding, a range of
            IP addresses from which domain specific translation addresses
            are picked."
  DEFVAL{ sourceAddrFilter }
  ::= { wfNatAddressRangeEntry 7 }
wfNatAddressRangeDomain OBJECT-TYPE
  SYNTAX DisplayString
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "When wfNatAddressRangeType is set to domainSrcAddrFilter or
             domainTransPool, specifies the Address Domain Name that this
             address range is valid for, otherwise set to null."
  ::= { wfNatAddressRangeEntry 8 }
```

F16. 12 G

```
wfNatAddressRangeTransPool OBJECT-TYPE
   SYNTAX INTEGER {
         inbound(1),
         outbound(2)
  ACCESS read-write
   STATUS mandatory
   DESCRIPTION
       "This attribute is only valid for the wfNatAddressRangeType as
             domainSrcAddrFilter(3). The value of this attribute decides
             where to get the translation address for this range from.
             This could be either the translation Pool defined for the
             inbound domain or the outbound domain for the packet in
             question."
  DEFVAL{ outbound }
   ::= { wfNatAddressRangeEntry 9 }
wfNatAddressRangeStaticNextHop OBJECT-TYPE
   SYNTAX IpAddress
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "The IP address of the next hop of this range entry."
   DEFVAL{ 0 }
  ::= { wfNatAddressRangeEntry 10 }
wfNatAddressRangeUnnumCct OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "This Nat Address range over the unnumbered interface."
  DEFVAL{ 0 }
  ::= { wfNatAddressRangeEntry 11 }
```

Fig. 12 H

}

```
wfNatStaticMappingTable OBJECT-TYPE
  SYNTAX SEQUENCE OF WfNatStaticMappingEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
       "'This table creates instances of pre-defined NAT translations."
  ::= { wfNatGroup 9 }
wfNatStaticMappingEntry OBJECT-TYPE
  SYNTAX WfNatStaticMappingEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
       "A single original source address to translated address
             translation."
  INDEX { wfNatStaticMappingTransAddress,
        wfNatStaticMappingProtocol,
        wfNatStaticMappingTransPort }
  ::= { wfNatStaticMappingTable 1 }
WfNatStaticMappingEntry ::= SEQUENCE {
    wfNatStaticMappingDelete
       INTEGER,
    wfNatStaticMappingDisable
       INTEGER,
    wfNatStaticMappingOrigAddress
       IpAddress.
    wfNatStaticMappingTransAddress
       ipAddress,
    wfNatStaticMappingProtocol
       INTEGER,
    wfNatStaticMappingOrigPort
       INTEGER,
    wfNatStaticMappingTransPort
       INTEGER,
    wfNatStaticMappingInDomain
         DisplayString,
    wfNatStaticMappingOutDomain
         DisplayString,
    wfNatStaticMappingStaticNextHop
       IpAddress,
    wfNatStaticMappingUnnumCct
       INTEGER
```

Fi6. 12 I

```
wfNatStaticMappingDelete OBJECT-TYPE
  SYNTAX INTEGER {
      created(1),
      deleted(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
      "Create/Delete parameter. Default is created. Users perform a set
             operation on this object in order to create/delete a static
             address translation entry."
  DEFVAL { created }
  ::= { wfNatStaticMappingEntry 1 }
wfNatStaticMappingDisable OBJECT-TYPE
  SYNTAX INTEGER {
       enabled(1),
      disabled(2)
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "Enable/Disable parameter. Default is enabled. Users perform a
             set operation on this object in order to enable/disable a static
             address translation entry."
  DEFVAL { enabled }
  ::= { wfNatStaticMappingEntry 2 }
wfNatStaticMappingOrigAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
       "The original (un-translated) address of the translation."
  ::= { wfNatStaticMappingEntry 3 }
wfNatStaticMappingTransAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
       "The translated address of the translation."
  ::= { wfNatStaticMappingEntry 4 }
wfNatStaticMappingProtocol OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
       "The IP protocol of the translation. Example values are
             6 for TCP, and 17 for UDP."
  ::= { wfNatStaticMappingEntry 5 }
```

F16.12 J

```
wfNatStaticMappingOrigPort OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-write
   STATUS mandatory
   DESCRIPTION
       "The original (domain specific) UDP or TCP port of the
              translation. This will only be relevent if the protocol
        is either UDP or TCP."
   ::= { wfNatStaticMappingEntry 6 }
wfNatStaticMappingTransPort OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
       "The translated UDP or TCP port of the translation. This will
              only be relevent if the protocol is either UDP or TCP."
   ::= { wfNatStaticMappingEntry 7 }
 wfNatStaticMappingInDomain OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-write
   STATUS mandatory
   DESCRIPTION
             "This attribute specifies the name of the address domain that this
             source translation shall be valid for. In other words, this
             translation shall only be valid for source addresses coming
              inbound from this domain."
     DEFVAL { "private" }
  ::= { wfNatStaticMappingEntry 8 }
 wfNatStaticMappingOutDomain OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-write
   STATUS mandatory
   DESCRIPTION
             "This attribute specifies the name of the outbound address
             domain that this translation will be valid for. In other words,
             this translation only applies to translations that will be
             forwarded out into this address domain."
     DEFVAL { "public" }
  ::= { wfNatStaticMappingEntry 9}
wfNatStaticMappingStaticNextHop OBJECT-TYPE
   SYNTAX IpAddress
   ACCESS read-write
   STATUS mandatory
   DESCRIPTION
       "The IP address of the next hop of this static entry."
   DEFVAL(0)
   ::= { wfNatStaticMappingEntry 10 }
```

F16.12 K

wfNatStaticMappingUnnumCct OBJECT-TYPE
SYNTAX INTEGER
ACCESS read-write
STATUS mandatory
DESCRIPTION
"This Nat static translation over the unnumbered interface."
DEFVAL{ 0 }
::= { wfNatStaticMappingEntry 11 }

F16.12 L

```
wfNatMappingTable OBJECT-TYPE
  SYNTAX SEQUENCE OF WfNatMappingEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "This table defines the current set of address translations
            that are in effect."
  ::= { wfNatGroup 10 }
wfNatMappingEntry OBJECT-TYPE
  SYNTAX WfNatMappingEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
      "A single original source address to translated address
            translation."
  INDEX { wfNatMappingTransAddress,
       wfNatMappingProtocol,
       wfNatMappingTransPort }
  ::= { wfNatMappingTable 1 }
WfNatMappingEntry ::= SEQUENCE {
    wfNatMappingOrigAddress
      IpAddress,
    wfNatMappingTransAddress
      IpAddress,
    wfNatMappingProtocol
      INTEGER.
    wfNatMappingOrigPort
      INTEGER,
    wfNatMappingTransPort
      INTEGER,
    wfNatMappingTxCount
      Counter,
    wfNatMappingRxCount
      Counter,
    wfNatMappingTimeout
      Counter,
    wfNatMappingMode
         INTEGER,
    wfNatMappingInDomain
         DisplayString,
    wfNatMappingOutDomain
         DisplayString
wfNatMappingOrigAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "The original (un-translated) address of the translation."
  ::= { wfNatMappingEntry 1 }
```

F16.12 M

```
wfNatMappingTransAddress OBJECT-TYPE
  SYNTAX IpAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "The translated address of the translation."
  ::= { wfNatMappingEntry 2 }
wfNatMappingProtocol OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "'The IP protocol of the translation."
  ::= { wfNatMappingEntry 3 }
wfNatMappingOrigPort OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "When the translation is for a TCP connection, this denotes
            the original TCP port number."
  ::= { wfNatMappingEntry 4 }
wfNatMappingTransPort OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "When the translation is for a TCP connection, this denotes
            the translated TCP port number."
  ::= { wfNatMappingEntry 5 }
wfNatMappingTxCount OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "Number of packets forwarded by NAT using this translation."
  ::= { wfNatMappingEntry 6 }
wfNatMappingRxCount OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
      "Number of packets received by NAT using this translation."
  ::= { wfNatMappingEntry 7 }
```

F16-12 N



wfNatMappingTimeout OBJECT-TYPE

SYNTAX Counter ACCESS read-only STATUS mandatory DESCRIPTION

"The time in seconds since this translation entry was last used.

This is used to age out translation entries."

::= { wfNatMappingEntry 8 }

wfNatMappingMode OBJECT-TYPE

SYNTAX INTEGER
ACCESS read-only
STATUS mandatory
DESCRIPTION

"This is the bit mask representing the type of this translation. Each bit specifies the type as follows:

The translation could be only ONE of the following three...

0x01000000 - This translation is origianted on this router,

i.e. this NAT router performed the translation.

0x02000000 - This translation is learned from the peer,

i.e. this translation was learned from the

peer using NAT Synchronization feature.

0x04000000 - This translation is owned,

i.e. it was originally learned from peer, but this router received traffic which used this translation.

...and only ONE of the following three.

0x00000010 - This translation is the STATIC translation.

0x00000020 - This translation is Dynamic(1 to 1) translation.

0x00000040 - This translation is N to 1 translation."

DEFVAL { 0 }

::= { wfNatMappingEntry 9 }

wfNatMappingInDomain OBJECT-TYPE

SYNTAX DisplayString ACCESS read-only STATUS mandatory DESCRIPTION

"This attribute specifies the name of the address domain that this source translation shall be valid for. In ther words, this translation shall only be valid for source addresses coming inbound from this domain."

::= { wfNatMappingEntry 10 }

F16.12 0





wfNatMappingOutDomain OBJECT-TYPE SYNTAX DisplayString ACCESS read-only STATUS mandatory DESCRIPTION

"This attribute specifies the name of the outbound address domain that this translation will be valid for. In other words, this translation only applies to translations that will be forwarded out into this address domain."

::= { wfNatMappingEntry 11}

END -- Wellfleet-NPT-MIB

F16.12 P